

31.7.09

Exhibit 7c

Turitea Reserve Foliar Browse Monitoring

June 2009



**Prepared for Palmerston North City Council
by
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1. Background

Foliar browse index monitoring (FBI) is a method for monitoring possum damage to forest communities. A small amount of FBI monitoring was established by Horizons Regional Council in Turitea Reserve in May 2003. This was partially re-measured by Horizons in June 2004 and then a complete re-measure undertaken in June 2007, June 2008 and June 2009 by PA Handford & Associates Ltd for Palmerston North City Council.

This monitoring is part of a wider monitoring programme for Turitea Reserve which is designed to track the status of forest ecosystems in the Reserve. Monitoring is occurring to assess performance against key objectives of flora and fauna protection and water supply protection. These objectives are set out in the Turitea Reserve Management Plan.

2. Method

The foliar browse method is described in detail in Payton et al (1999). It involves visual assessment of the foliage cover and condition of individual trees within plots set out in the forest area. Only possum susceptible tree species are assessed. The main species assessed in Turitea Reserve were Tawa, Mahoe and Kamahi

A total of 7 standard FBI plots were established in 2003. This includes 5 plots around the dams and lower catchment and 2 plots close to the catchment ridgeline access road.

In addition to the standard FBI method an additional approach was introduced by Malcolm Todd of Horizons Regional Council in 2003. This involved a "view point plot" where trees visible from a vantage point were rated in terms of some of the foliar browse index parameters. Three of these plots were established, two adjacent to the lower reservoir and one at the boatshed on the upper reservoir. It was found to be difficult to repeat this method consistently for many species in subsequent years so the use of data from these plots has been limited to assessment of possum browse on Mamaku (*Cyathea medularis*) tree ferns.

In 2004 a series of digital photographs were taken from the view point locations showing the areas of forest assessed and their general condition. These photographs were repeated in 2007, 2008 and 2009.

Analysis of data from repeat measurement of FBI plots has been limited to those tree stems that are present through all years considered. A small number of tree stems have died between each measurement. Only stems that were live at each assessment are included in the analysis to avoid potential bias from changing numbers of stems included from year to year.

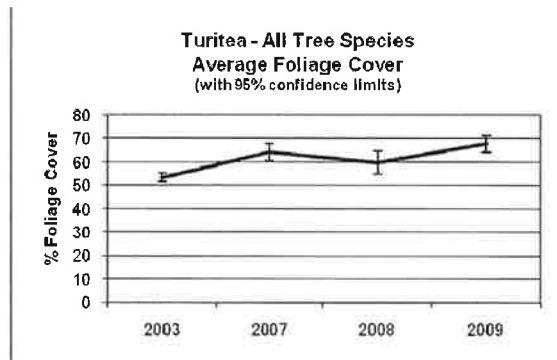
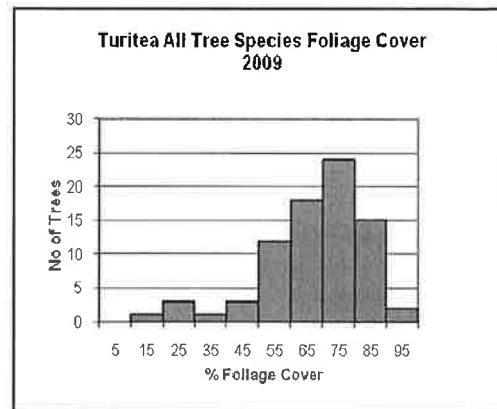
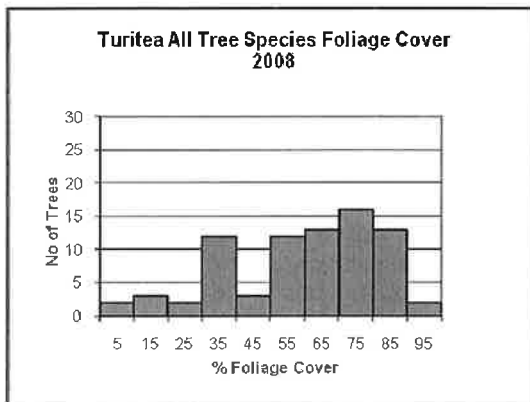
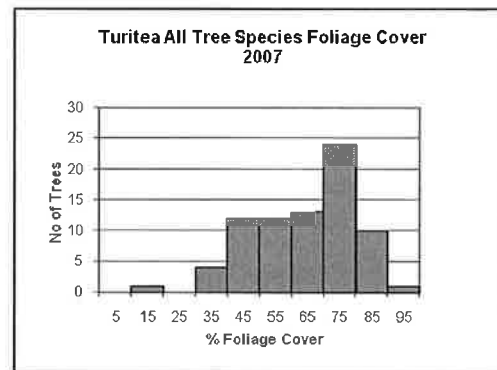
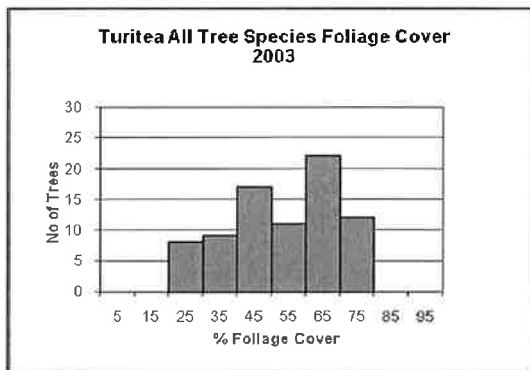
3. Results

3.1 Foliar Browse Index 2003 2008

Because foliar browse plots were only partially measured in 2004, analysis and presentation has focussed on presenting the complete results for 2003, 2007, 2008 and 2009.

3.1.1 Foliage Cover

One of the indicators assessed under the FBI method is the percentage foliage cover. Using a guide sheet showing different levels of cover, the percentage foliage cover of individual trees is visually estimated. Numbers of trees with different percentage foliage cover in 2003, 2007, 2008 and 2009 are shown in the charts below.

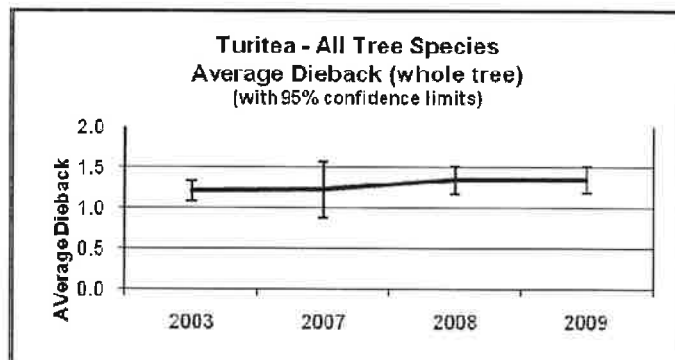
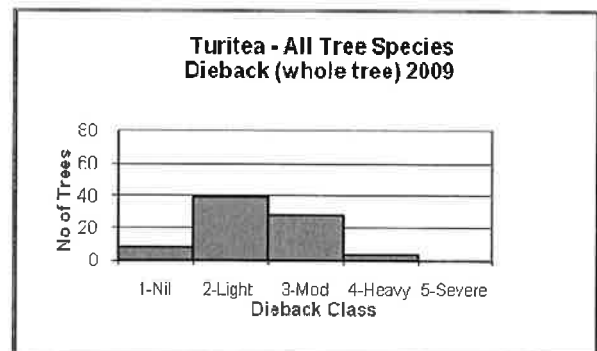
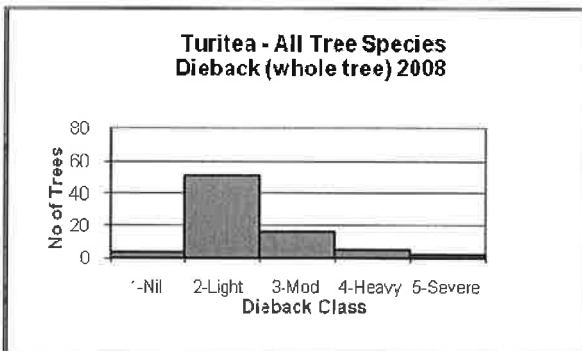
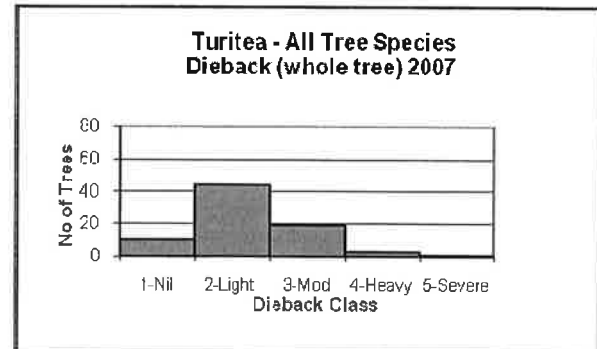
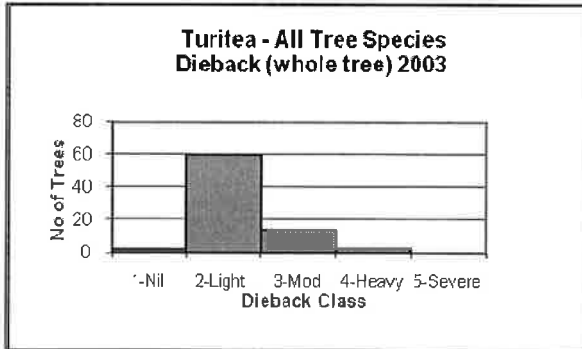


Comments

- There appears to have been an increase in average foliage cover between 2003 and 2007. This includes a large increase in trees assessed as having 75-85% cover.
- Average foliage cover has remained fairly stable since 2007.
- In 2008 there was an increase in the number of trees recorded with relatively low foliage cover, particularly in the 35% cover class. This was offset by a slight increase in stems with high percentage cover. Occurrence of some trees with low cover in 2008 was thought to be a result of drought stress on vulnerable trees following a particularly dry 2007/08 summer.
- Foliar browse scores appear to have increased slightly since 2008, possibly showing a recovery from the effects of earlier drought.

3.1.2 Dieback

Dieback is the presence of conspicuous dead branches or branchlets in the canopy. Results are summarised in the charts below.

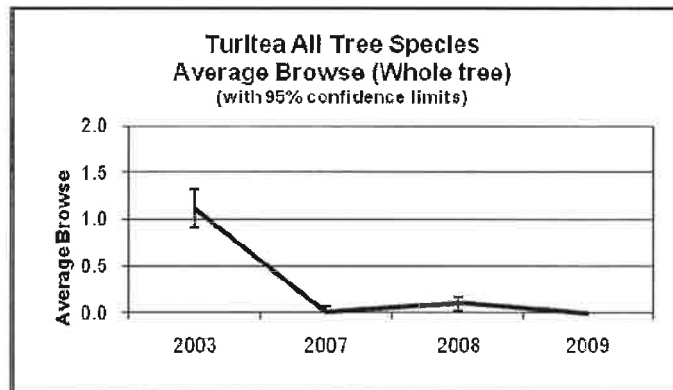
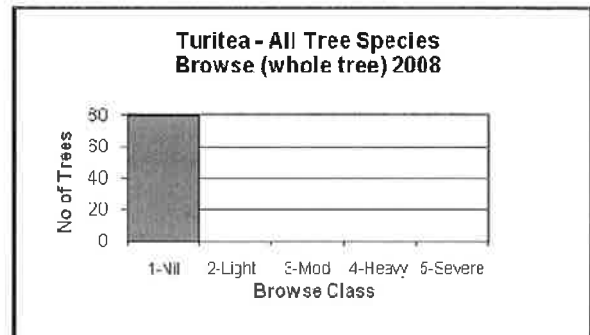
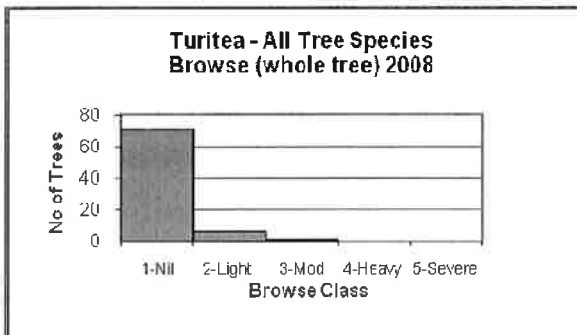
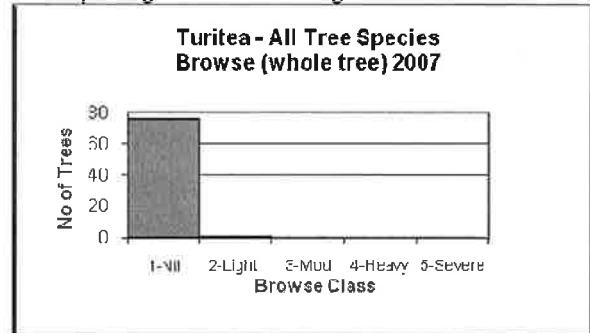
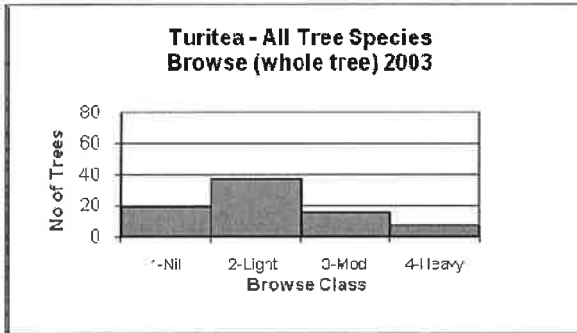


Comments

- Relatively light dieback scores were recorded in 2003, 2007, 2008 and 2009.
- There is possible indication of an improving trend in dieback since 2003.

3.1.3 Possum Browse

The proportion of possum browsed leaves in the canopy is assessed and the severity of browse is classified for each tree. Assessment of trees in the Turitea plots gave the following results.

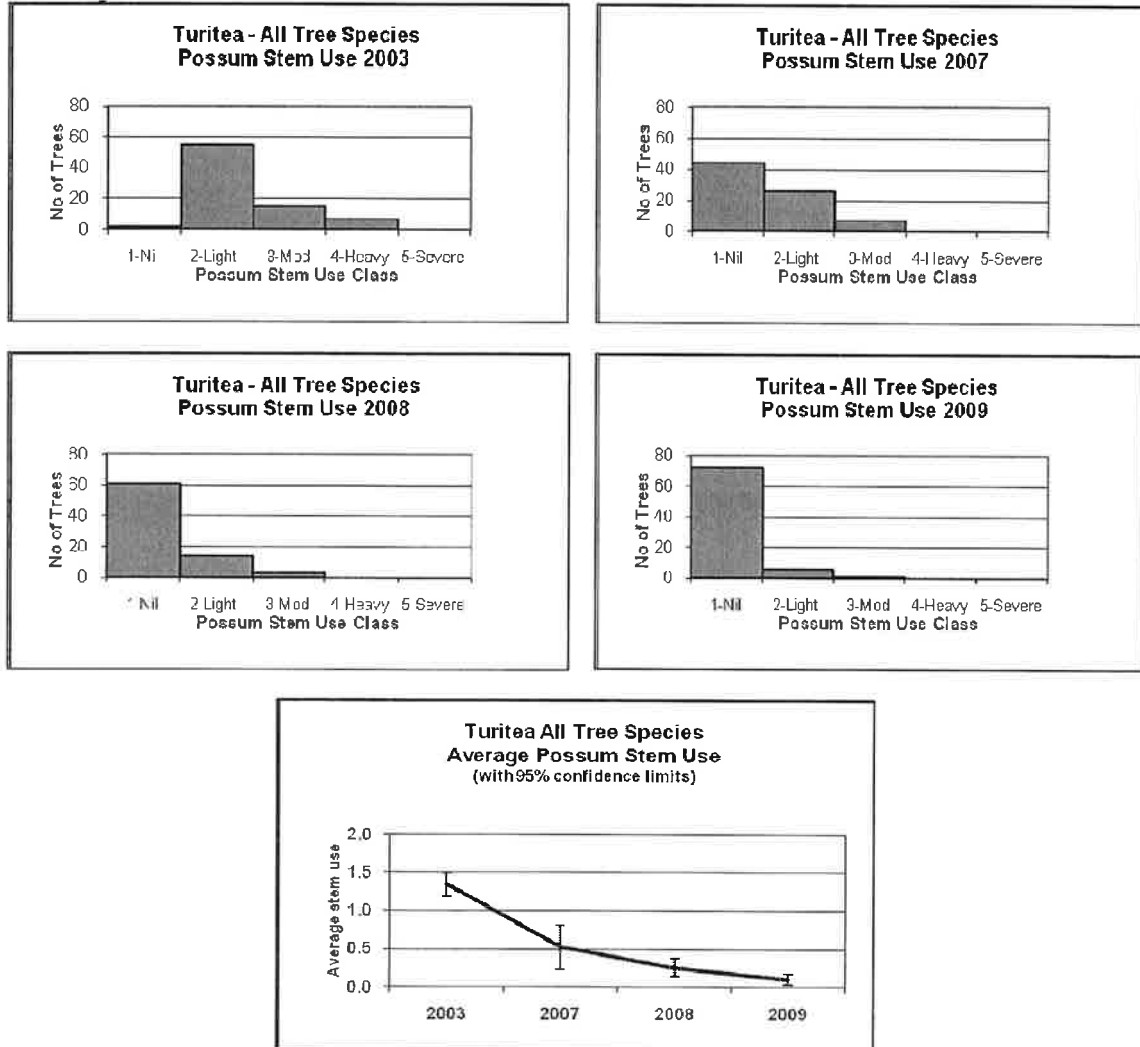


Comments

- There has been a major reduction in the intensity of possum browsing between 2003 and 2007.
- Very few trees were browsed in 2007, 2008 or 2009.

3.1.4 Possum Stem Use

Recent possum use of the lower 2m of the tree trunk of each tree is examined. Stems are searched for evidence such as scratching and bite marks by possums. This assessment gave the following results.

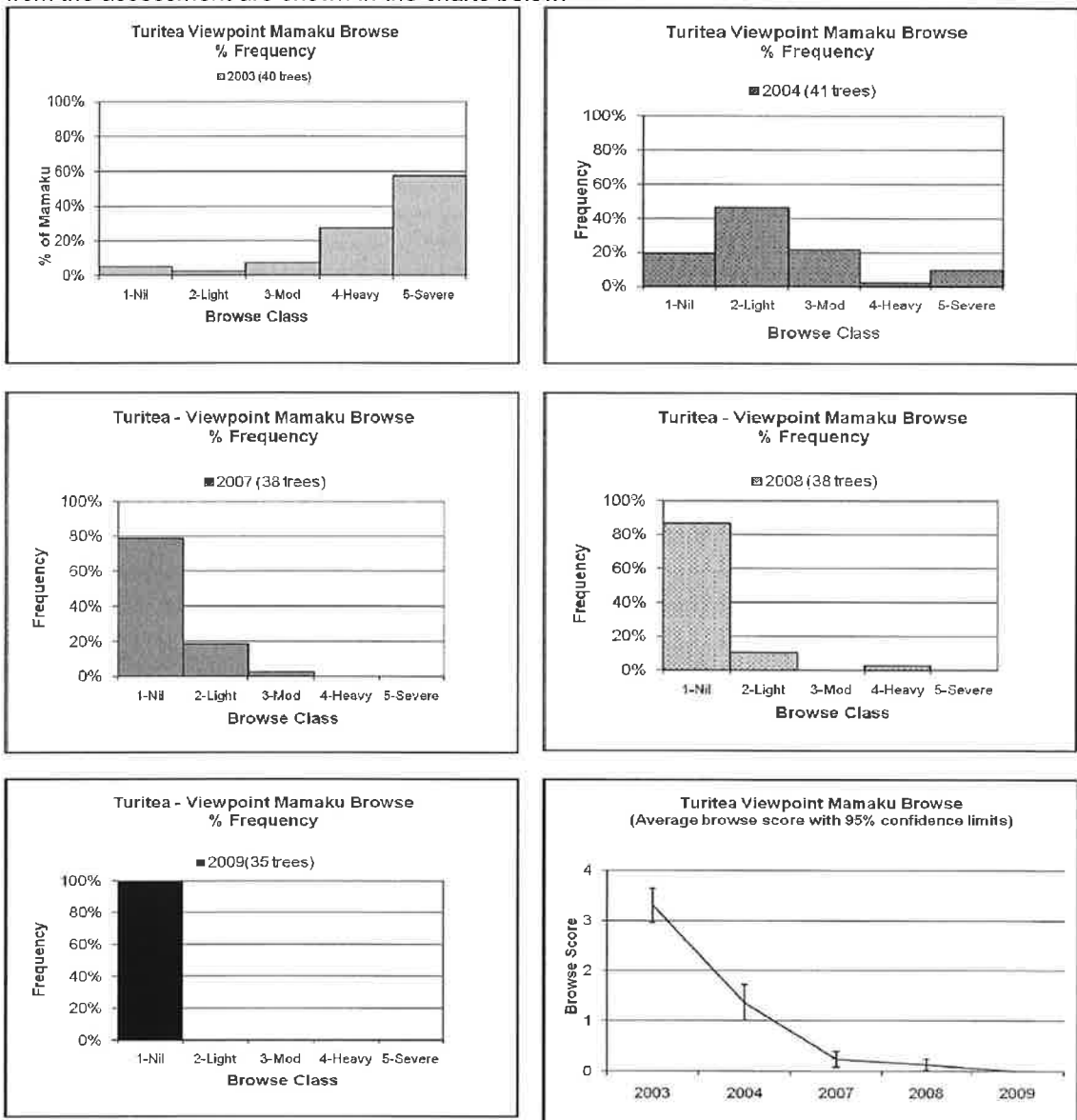


Comments

- There was a clear reduction in average possum stem use between 2003 and 2007.
- Average stem use shows an ongoing downward trend between 2003 and 2009.

3.2 View Point Plots

Mamaku tree ferns (*Cyathea dealbata*) were assessed for intensity of possum browse at three "viewpoint" locations adjacent to the Turitea Reservoirs where a number of treeferns could be seen. Previous data was available for these viewpoint plots for 2003, 2004, 2007 and 2008. There are some variations in the number of mamaku treeferns assessed each year. This is due to some difficulties in distinguishing between individual treeferns across the different years of measurement. These variations are not expected to affect the overall assessment of browse intensity. Results from the assessment are shown in the charts below.



Comments

- A clear reduction in browse on mamaku crowns between 2003 and 2007.
- Levels of browse in 2004 were lower than 2003. This may be the result of an early reduction in possum browsing. However possum control operations were in their early stages when the 2004 assessment was undertaken. There is a possibility of some of this difference being due to observer difference. However, there has been considerable further reduction in browse since 2004.

- Browse scores remained low in 2008 and have fallen to zero in 2009.
- There is a clear downward trend in possum mamaku browse since 2003.

3.3 View Point Photographs

Photographs were taken from each of the 3 viewpoint locations adjacent to the Turitea Reservoirs in 2004. These photographs were repeated (as closely as possible) in 2007. Additional photos identifying individual trees were also taken in 2007. Photographs were repeated in 2008 and 2009.

Light conditions were somewhat different between the sets of photographs with slightly more overcast conditions occurring in 2007, 2008 and 2009. While this does make the photographs more difficult to compare, some apparent indications of improvement in canopy condition are shown on comparison between the 2004 and 2007 photographs of the areas of tawa forest. The 2008 and 2009 photographs appear to suggest a maintenance or possible ongoing improvement in canopy condition since 2007. Observations on the ground in 2008 suggested that some subcanopy mahoe trees may have declined over the summer, possibly as a result of drought stress, but were showing early new growth. This was confirmed in 2009 with recovery of mahoe occurring.

A selection of the more easily examined photographs is provided in Appendix One. Some photos with major changes in shadow or exposure have not been presented.

As identified in previous reports, photos taken at viewpoint one particularly appear to show less visibility of sparse "sticky" areas in the canopy between 2004 and 2008. There is an apparent general change in texture on photos to a softer "fluffy" look between 2004 and 2007 that may be associated with development of thicker foliage cover. As identified, this possible improvement appears to have been maintained or enhanced in 2008 and 2009.

These photographs will continue to be repeated in future years to confirm visual changes in canopy health.

4. Discussion

The results presented show an apparent reduction in possum impacts between 2003 and 2007. These reduced levels of possum impact were maintained or enhanced in 2008 and 2009.

FBI assessments show a clear increase in foliage cover, a reduction in browse, and a reduction in stem use over the period between 2003 and 2009. This suggests that the forest canopy improved in condition over this period.

Since 2003 there has been significant management input in the Reserve to reduce possum numbers. Possum populations have now fallen to low levels with intensive possum control being introduced from 2006/07 and maintained since this time with regular pulsing of toxic bait through bait stations. Trap catch monitoring of possums undertaken in March 2008 showed that possum residual trap catch is now at or below 5% RTC through the water supply catchment area where the FBI plots are located. The current low levels of possum populations appear to be having an ongoing positive effect on forest canopy condition.

The Foliar Browse Index technique involves visual estimates of condition classes by observers. Because of this, it is always subject to some observer bias. One observer may have a tendency to under or over estimate foliage cover etc compared to another. Payton et al (1999) identified that this variation does occur but there is a high probability that observers can assess to within 1 condition class or 10-20% foliage cover. It appears very unlikely that the level of difference shown by these results over the study period would be a result of observer bias. The same observer has been used since 2007.

The summer of 2007/2008 was particularly dry through the study area. During fieldwork drought impacts were observed on some species, particularly mahoe and kamahi, but not tawa which is the predominant species in plots. Mahoe and kamahi showed evidence of yellow leaves and past leaf drop. However mahoe was showing abundant growth of new leaves by the time 2008 fieldwork was undertaken in June. This recovery of mahoe has continued in 2009.

The improvement in canopy condition between 2003 and 2007 identified by the foliar browse assessment appears to be supported by repeat photographs taken at the Turitea Reservoirs. There are apparent improvements in canopy appearance between 2003 and 2007, though changes in light conditions make interpreting photographs more difficult. Repeat photographs taken in 2008 and 2009 appear to show similar or improved canopy condition compared to 2007, suggesting improvement in canopy condition is at least being maintained.

References

Payton I.J, Pekelharing C.J, Frampton C.M (1999). Foliar Browse Index: A method for monitoring possum (*Trichosurus vulpecula*) damage to plant species and forest communities. Landcare Research 1999

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Appendix 1: Viewpoint Photos 2004, 2007, 2008 & 2009

Turitea Viewpoint 1

2004 (turitea-tv1-110604112932)



2007 (DSC03578)



2008 (6051067)



2009 6186609



2004 10604113006



2007 DSC03579



2008 6051068



2009 6186611



2004 110604113028



2007 DSC03580



2008 6051069



2009 6186612



2004 110604113126



2007 DSC03582



2008 6051070



2009 6186613



Turitea Viewpoint 3
2004 110604101338



2007 DSC03588



2008 6051112



2009 6186656



2004 110604101400



2007 DSC03590



2008 6051115



2009 6186657

